

Comment on quant-ph/0506105: The modified Grover algorithm cannot improve the Grover algorithm

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In a recent paper in this eprint server [1], A S Gupta, M. Gupta and A. Pathak proposed a modified Grover algorithm that would exponentially accelerate the unsorted database search problem if the number of marked items is known. If this were true, it would represent a major fundamental breakthrough in computer science, mathematics, quantum information and other related branches of sciences.

However the algorithm is not valid. We will explain it in this brief comment.

The very reason that their modified algorithm can not be true is the realization of Eq. (6) in their paper. This unitary operation actually implement a $k\theta$ rotation in a 2-dimensional space which will require $k/2 \simeq O(\sqrt{N})$ iterations in the Grover algorithm. This operation is central to the exponential speedup. However, one cannot build this operation without the use of the query. When one uses the query, it would require $O(\sqrt{N})$ number of queries to implement this operation. Hence the exponential speedup is only nominal.

It has been shown that Grover's algorithm is optimal[2]. This optimality theorem has been proven valid sofar. Moreover, it seems that classical NP-Complete problems such as the SAT problem is unlikely to find an exponential speedup, even with the use of a quantum computer.

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- [1] A S Gupta, M. Gupta and A. Pathak, Modified Grover algorithm in cases where the number of solutions is known. quant-ph/0506105.
[2] C. Zalka, Grover's Quantum Searching Algorithm is Optimal, Phys. Rev. A. 60, 2746(1999);